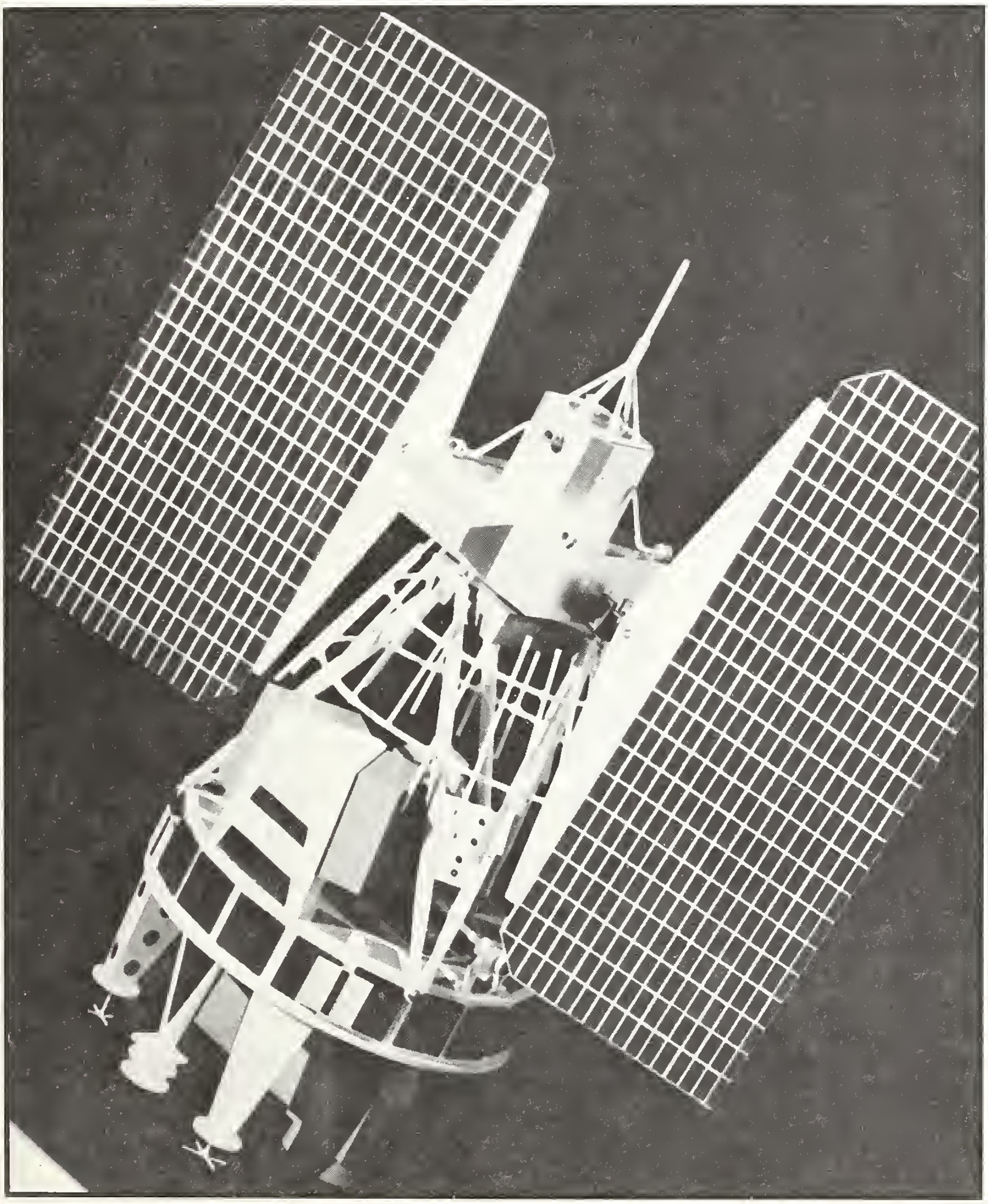
December 25, 1978

Foreign Agriculture

Foreign
Agricultural
Service
U.S. DEPARTMENT
OF AGRICULTURE



Drawing of the Landsat Satellite used to study the earth's natural resources.

New Focus for Crop Reports by Satellite

Remote sensing by satellite—likened to putting the whole earth under a microscope—will be incorporated into the U.S. Department of Agriculture's crop assessment programs beginning early next year. One key goal of this new undertaking is to provide better and faster information on crop shortfalls or surpluses around the world.

Frosts in Brazil, floods in India, drought in China, a superabundance of soybeans in major producing countries—these are among the trade-influencing conditions whose impact may one day be assessed from satellites orbiting some 570 miles above the earth's surface.

Such a breakthrough would permit swift action to minimize marketing and distribution problems that arise in part because of the lack of early crop-condition information in much of the world. With output from 1 out of every 3 acres now moving into export—a record $27.3 billion worth in fiscal 1978—the benefits to U.S. agriculture and the U.S. economy could be significant.

To make practical use of this tool, the Foreign Agricultural Service is moving toward a new Crop Condition Assessment (CCA) program designed to support commodity analysts in making production forecasts. The program—a counterpart to remote sensing research and development efforts by other Government agencies—is derived from a recently concluded trial in remote sensing called the Large Area Crop Inventory Experiment (LACIE).

In addition to looking for potential trouble spots in world production, the CCA will carry out goals set forth in a so-called Secretary's initiative as presented by Agriculture Secretary Bergland last February. The seven points stressed in that pronouncement are:

- Early warning of changes affecting production and quality of commodities and renewable resources;
- Commodity production forecasts;
- Land use classification and measurement;
- Renewable resources inventory and assessment;
- Land productivity estimates;
- Conservation practices assessment; and
- Pollution detection and impact evaluation.

Jimmy Murphy, acting director of the new CCA Division, describes the program's strategy in this way: "We will use satellite data to determine area of occurrence—let's say of a drought or freeze—and make an assessment of the severity. We also want to know about bumper crop prospects."

Some of the priority countries that will be looked at in the new program are the USSR, the People's Republic of China (PRC), India, Argentina, Australia, Brazil, and Mexico. Crops might include wheat, barley, corn, grain sorghum, rice, soybeans, sunflowers, peanuts, and oilseeds, cotton, coffee, tobacco, and sugarcane.

"This is not going to happen overnight," says Murphy. "At least 3 to 5 years will be needed to pinpoint and collect reference data for all of the areas in which we're interested.

"Moreover, it's more of an early warning analysis and impact assessment, rather than an inventory approach," Murphy points out.

The workhorses of this remote-sensing system are Earth Resources Satellites called Landsats. Landsat 3 was launched in March 1978 and augments one earlier Landsat satellite still in operation. Landsat D—to be launched in the 1980's—will continue the coverage and should provide improved capability to identify crops grown in small fields typical of parts of the United States and Canada and many developing nations.

Each Landsat satellite scans almost all areas of the earth once every 18 days, covering at one sweep about 10,000 square miles. A type of vibrating mirror called a multispectral scanner takes digital measurements of light reflected off surfaces on the ground. The resulting images—in the red and green bands of light and in two infrared bands that cannot be seen by the human eye—are recorded into tape and transmitted to a ground station for further processing.

Resulting data can be fed directly into computers for analysis. They also can be reconstructed into black and white or false-color pictures. In the latter case, healthy, growing vegetation registers bright red, and disease- and insect-damaged crops take on gray tones.

The CCA program will use Landsat data and LACIE-developed techniques to monitor, detect, and measure the impact of natural and manmade events on crop production. Digital Landsat data—when put through a computer—tell a lot about crop stress, damage caused by insects and diseases, and other factors that affect crop yields. This direct use of

By Beverly Horsley, Associate Editor, *Foreign Agriculture*.

the digital data provides more precise information than what can be discerned by the human eye from Landsat imagery and reduces time demands on the analysts.

Murphy emphasized that for now these data must be analyzed in conjunction with data from many sources —weather reporting stations and satellites, U.S. agricultural attaché reports, and foreign countries.

The research and development effort that complements this operational program is a multidepartment project. Participants include three partners in the earlier LACIE undertaking —the U.S. Department of Agriculture (USDA), the National Aeronautics and Space Administration (NASA), is the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA). In addition, the U.S. Department of the Interior and the Agency for International Development will be involved.

Research program participants within USDA include the Economic, Statistics, and Cooperatives Service (ESCS), the Science and Education Administration (SEA), the Soil Conservation Service (SCS), the Forest Service, the World Food and Agriculture Outlook and Situation Board, and the Federal Crop Insurance Corporation.

"We will do some preliminary work in fiscal 1979 and then move into a full-scale program during 1980 through 1985." says Ross Packard, USDA coordinator of the research and development effort. During this time, remote sensing research will explore some exciting new areas.

Future research will focus on quantitative monitoring for drought, already done with some encouraging though limited results under LACIE; grain winterkill; and soil temperatures. Yield models that use more and better weather data will be developed, and infrared data will be used to a greater extent in calculating yields.

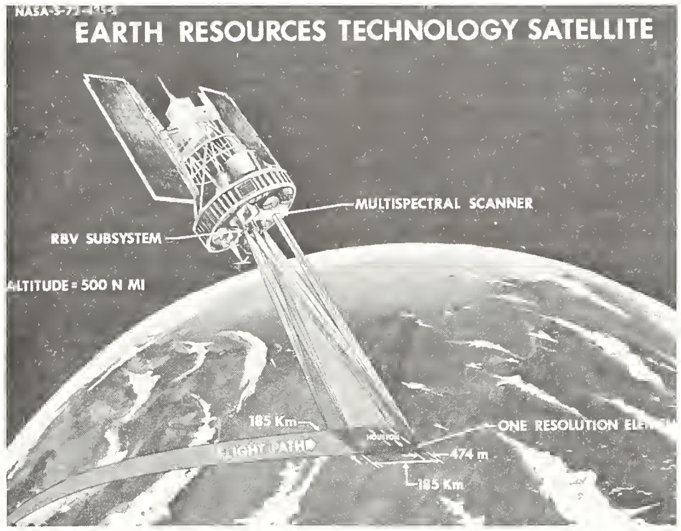
"We will be doing more work with vegetative indexes derived from the infrared data," says Packard. "For instance, there is the green index number (GIN) used to summarize the condition of vegetation within a Landsat scene. Under this, digital data from the Landsat satellite are put into a scale ranging from 0 for bare soil to 15 for healthy green vegetation. Over time, an understanding of the relationship between these readings and actual yields will allow analysts to quantitatively define production possibilities based on the GIN.

"One of the important parts of our research program will be to determine just how good the techniques are. In some cases, we may be able to state quite accurately that production of a given crop will decline say 10 percent from the previous season's."

Packard also hopes to see progress in developing sampling strategies, crop calendars, and pilot projects for production estimation; in assessing land, forest, and soil resources; and in pollution detection-evaluation.

"In the pollution program, for instance, we hope to detect, identify, and map the sources of pollution related to agricultural and forestry practices," says Packard. "This will probably combine satellite, aircraft, and ground data systems."

These goals represent a marked broadening of remote sensing uses from the



Top: A simplified look at the Landsat satellite and how it works. Middle, Landsat imagery showing crops and fields. Bottom, imagery of the same region following computer classification of the Landsat digital data.

limited outreach of the recently concluded LACIE project, which covered only one crop—wheat.

That experiment—divided into three phases during its October 1974-September 1978 lifespan—used Landsat data to estimate wheat production in the United States, Canada, and the USSR. It also allowed for technology problem definition in Brazil, Argentina, Australia, the PRC, and India.

Working with basic units called sample segments—5 x 6 nautical miles or 25,000 acres, further broken down into pixels, or 1.1 acre—analysts selected training fields from the reconstructed pictures. They identified specific crops in these segments and then trained the computer to pick out other fields that looked similar. In this way, area estimates were made.

Yield models based on historical weather information were used together with these area estimates to make production forecasts.

The LACIE estimates were mailed each month ahead of the official USDA crop estimate. Results also were compared directly with those obtained on the ground in certain test areas, or so-called blind spots, of the United States.

The LACIE goal—90/90 accuracy at the country level, or estimates within 10 percent of the final official estimate 90 percent of the time—was met during the experiment's third phase for the U.S. winter wheat and the Soviet wheat crops. Surprisingly, results were especially impressive in the USSR: LACIE estimates in 1976/77 indicated quite early that drought would sharply reduce spring wheat production there.

The Soviet Union, of course, has been one of the big unknowns in world grain trade recently—in part because of a lack of early-season information about the country's highly variable grain crop. As leading suppliers of Soviet grain imports, the U.S. trade is anxious to gage as soon as possible the extent of that country's needs. In fiscal 1978, the United States alone shipped almost 14 million metric tons of grain to the USSR.

"One of the most critical problems encountered," says Murphy, "was distinguishing between spring wheat and spring barley—both grown at about the same time—in the northern United States and Canada. Moreover, resolution of the satellite's multispectral scanner was not good enough to separate fallow from wheat in these same areas, which were often strip-cropped in widths of 300 feet or less.

"We also had problems with the yield models, which were rather primitive. While in some areas they worked well, in others, they did not capture the full range of deviation from normal."

Another handicap was the long time required to obtain and process data from the satellite—anywhere from 29 days on the average to 50 or 60 days.

Murphy feels that this delay problem will be solved under the CCA program as time spent analyzing sample segments is cut further and processing of the satellite data speeds up. "Starting in June 1979," says Murphy, "Landsat data collected over foreign areas will be downlinked to stations in Alaska and California, as in the past.

"But from there—rather than being mailed to the Goddard Space Center, as previously done—data will be retransmitted to a domestic communications satellite and received at the Johnson Space Center approximately 60 hours after collection. We, in turn, plan to have our first assessment of an area available 72 hours later."

Packard, who did crop estimates for the Statistical Reporting Service in the 1950's, cautions that remote sensing is not an end all. "It's easy to get overly impressed with space-age technology and supercomputers, but observations made from satellites are not all that different from those made with our eyeballs in the early days.

"When I first started with the SRS, the farmer would look across the crops in his fields and his neigh-

Symposium Reviews Remote Sensing Trial

U.S.-style crop reports can be produced from data gathered by earth-orbiting satellites. However, the high costs involved and the limited range of experience so far indicates that other uses of remote sensing—such as for early warning of pending crop shortfalls or surpluses—should first be explored.

These are some of the conclusions of an October 23-26 LACIE Symposium at the Johnson Space Center, Texas, where some 750 participants from 19 countries met to review results of a 3-year experiment in remote sensing.

Called the Large Area Crop Inventory Experiment or LACIE, this trial focused on using space-satellite data to forecast wheat production during crop years 1974/75 through 1976/77 in several test areas. Initially it looked at wheat production in the U.S. Great Plains—a "yardstick" region against which results from other countries were compared—and the Canadian Prairie Provinces. Later, it was expanded to include wheat crop forecasts for the USSR and limited forecasting trials for wheat in the People's Republic of China (PRC), Argentina, Australia, Brazil, and India.

The experiment was a joint undertaking by three Government departments: The National Aeronautics and Space Administration (NASA), the U.S. Department of Agriculture (USDA), and the Commerce Department's National Oceanic and Atmospheric Administration (NOAA). Officially ended in September 1978, LACIE is being succeeded by a two-part effort: an operational program carried out by USDA's Foreign Agricultural Service and an inter-departmental research and development program. (See accompanying article.)

The objective of the LACIE Symposium, according to moderator Richard S. Johnston, Johnson Space Center Director of Space and Life Sciences, was to report on:

- LACIE results;
- An independent peer evaluation of the program;
- How the results could be applied to future programs.

bors' fields and say crop conditions appear to be a certain percentage of normal. To estimate yields, we went into the wheat fields, laid out small frames, got down on our hands and knees, and counted individual wheat plants. Having gone through that, I find it interesting to be on a project where we're looking down from about 500 miles and trying to measure production.

"In short, my experience has been that one technique does not replace the other—that it becomes only a part of the estimator's tool kit."

So what is the potential benefit of this high-flying estimating tool?

Murphy sees it as a means of filling the information gaps that still confound farmers, traders, and consumers. "Of course, our primary user is the American farmer. We think that timely information about foreign crops will give the farmer greater flexibility in choosing among crops and in taking advantage of markets," Murphy explains.

"For the consumer and the marketplace, timely information can help stabilize the wide fluctuations in prices. And export programs might be better planned.

"From a humanitarian standpoint, remote sensing can help identify developing crises, such as Bangladesh during the early 1970's, when thousands of people died in the wake of severe drought." □

In opening the symposium, Christopher C. Kraft, Director of the Johnson Space Center, praised LACIE's success and its future possibilities. "We hope it is a forerunner of much new work that must be done to take advantage of the space platform," he said.

Richard Lawless, Deputy Administrator, NASA, called LACIE "a successful program born of a lot of hard work . . . The basis has really been laid to exploit application of remote sensing for agriculture and other uses."

Most Symposium participants agreed that remote sensing could eventually help close the information gaps that hamper production and trade. Conventional crop forecasting systems for the United States, Canada, and a few other developed countries already have gone a long way toward reducing this information problem. USDA midseason estimates have been within plus or minus 10 percent of actual outturn in each of the last 10 years for the U.S. crop, in 9 out of 10 years for the Canadian crop, and in 8 out of 10 years for the Australian crop.

However, USDA forecasts of production in several foreign areas have been difficult to make, in large part because of the dearth of crop information available from these countries.

Much of the Symposium's plenary session was devoted to the history of remote sensing and results of the LACIE program that grew out of that experience.

R. B. MacDonald, LACIE project leader, harked back to the advent of the space age in the 1950's with the launching of earth-orbiting satellites by the United States and the USSR. "This opened the door to the development of sensor-carrying vehicles that could in the future take measurements of the earth's surface and its atmosphere on a global basis and in a matter of hours or days," said MacDonald.

One of the first efforts to tap this new information source was formation of the interdisciplinary Committee of Remote Sensing for Agricultural Purposes, which looked at how the new technology could be applied to provide timely and accurate information on crops and forestry.

This technology was used in a synoptic way to, say, "identify a cornfield by looking at spectral spots or color of the field, as opposed to using high resolution photography to recognize the shape of a corn plant."

Following several experiments—including a seven-State corn blight watch in the United States during 1970—a joint experiment called CITARS (Crop Identification Technology Assessment for Remote Sensing) was begun in 1973. This "provided strong indicators that high accuracy could be achieved with only minimal analyst intervention" and laid the groundwork for LACIE procedures.

Then in October 1974, the LACIE program was launched to test the use of remote sensing as a means of estimating crop production in the United States and other countries.

Among points brought out by other speakers:

- The essential thrust of LACIE was to integrate technology into an experimental system, expose that technology to conditions that a future operational system might experience, achieve at-harvest performance goals of 10 percent of a country's true production 90 percent of the time, and evaluate the program continuously. Another goal was to release LACIE crop estimates within 14 days of the receipt of the satellite data.
- Wheat was chosen as the LACIE test crop because it is grown worldwide and is among the best understood crops. Resulting experiments with digital data obtained by the satellites revealed much about changing land management practices, production inputs, and soil moisture.
- Countries selected for the experiment are among the world's leading wheat producers and thus have a huge influence on world trade in wheat. Additionally, USDA production forecasts for several of these countries—including the USSR and the PRC—have been handicapped by the lateness or lack of official Government information on crop production.
- Data on temperature, rainfall, and other weather conditions were obtained from ground weather stations around the world and converted into information on potential yield.
- On-going uses of remote sensing will focus on getting satellite data as fast as possible and using them to assess crops and conditions in areas deemed important by USDA. In this way, agronomists, soil scientists, economists, and other specialists can adapt remote sensing procedures to their specific needs.
- Appropriate LACIE technology has been transferred to a USDA crop condition assessment function, which will provide data to the FAS commodity analysts commencing in late 1979.—*Beverly Horsley, FAS* □

Brazil's Dairy Industry Expanding Rapidly

By Edmond Missiaen

Brazil's dairy industry has boomed in the past 5 years, aided by strong Government support and rising imports of dairy breeding cattle and semen, in part from the United States.

The dairy industry's 1978 milk output probably was 10-11 percent higher than the 10.8 million metric tons produced in 1977 and well above the 7.5 million tons produced in 1973, when Brazilian dairy output began rising at a rapid rate.

Favorable producer prices have been the biggest stimulant to this growth. About 31 percent of Brazil's fluid milk production goes to processing plants for manufacture of powdered milk, cheese, butter, and related products, but data on production of these items are not available.

The share of Brazilian milk used for processing has been increasing as a result of some easing in price controls on manufactured dairy products. Government-financed stocks of powdered milk, cheese, and butter also have encouraged the diversion of more milk to the manufacturing sector.

Even with the quick growth in production, the Brazilian dairy industry has been hard pressed to meet the rising demand for milk and other dairy products.

The author is U.S. Agricultural Officer in São Paulo.

As a result, imports of dairy products have increased along with production.

In 1977, imports of powdered milk totaled 48,000 tons, with Ireland, other European Community (EC) countries, and Poland the principal suppliers. Cheese imports—mostly from Argentina and Uruguay—amounted to 13,000 tons in 1977.

Imports of dairy products are expected to be down in 1978 from year-earlier levels, with powdered milk imports declining to about 10,000 tons.

Practically all of 1978's powdered milk imports are for consumption in Government nutrition programs, especially school lunches. The low cost of subsidized powdered milk exported by EC countries has stimulated Brazil's imports of this item.

Brazil's national dairy policy is based on maintenance of a favorable producer price for milk, which is obtained through a Government-guaranteed price adjusted several times a year.

The guaranteed producer price for the basic type of milk most commonly produced (Type C) was increased on July 1, 1978, to the equivalent of 23 U.S. cents per liter ($10.10 per 100 lb).

A producer price about 50 percent higher than the price for Type C milk is usually set for Type B milk, which must meet more stringent bacteria count and butterfat content regulations, and must come from farms that meet minimum sanitary requirements defined and verified by the Ministry of Agriculture.

The Government sets the retail ceiling price for Type C milk—currently the equivalent of about 27 cents per liter in the larger cities. To hold the price down, a marketing subsidy equal to about 1 cent per liter is paid to distributing firms.

Type B milk, which is not subject to a ceiling price, usually retails for about twice the price for Type C milk. Type B milk is available only in the metropolitan areas of São Paulo, Rio de Janeiro, and Belo Horizonte.

In São Paulo, Type B milk accounts for about a third of total fluid milk distribution, but its share is much less in the other two cities.

The Government also sets retail ceiling prices on whole milk powder and on most popular types of cheese.

Because of the wide seasonal variations in milk production, the Government has a policy of financing stocks of powdered milk, cheese, and butter. Stocks are accumulated during the heavy production period and distributed during the low-output period. Powdered milk stocks often are distributed in the form of reconstituted dry milk.

Brazil's rapidly rising demand for dairy products plus favorable Government price and production policies have led to great interest by producers in improving productivity.

Genetic improvement of herds is recognized as one of the basic steps in improving productivity as reflected in the expanded imports of dairy breeding stock and semen over the past few years.

In 1977, imports of breeding cattle were valued at about $10.5 million (f.o.b. value) of which about $1.5 million worth were from the United States. About two-thirds of these imports probably were dairy breeding animals.

The U.S. share of registered purebred imported animals undoubtedly was larger than the U.S. share of total imports because large numbers of pure-by-cross breeding cattle are imported from Argentina and Uruguay.

An estimated 2,000 registered purebred dairy breeding animals were imported during 1977, although exact data are not available. This total reflects an increase of 40-50 percent over estimated 1976 imports.

About 90 percent of these animals were Holsteins, with Simentals, Jerseys, Brown Swiss, and Guernseys comprising the rest. U.S. export data show 1,159 dairy breeding animals, valued at $2.7 million, shipped to Brazil during calendar 1977—almost triple the number shipped during the previous year.

During 1977, the Brazilian Holstein Association authorized importation of 3,321 registered purebred animals, although actual imports probably were fewer.

Of total authorizations, the United States led with 1,130 head, followed by Canada with 1,096, Uruguay 700, and Argentina 382. The remaining 13 were for Dutch and German cattle. Brazil's dairy cattle imports in 1978 are expected to total about the same as in 1977.

Semen imports are also contributing to the genetic improvement of Brazilian dairy herds. The Ministry of Agriculture reports semen imports during 1977 at

298,000 doses, of which about 167,000 doses (56 percent) were of dairy breeds—122,000 Holstein, 24,000 Simental, 8,000 Jersey, 6,000 Brown Swiss, 4,000 Ayrshire, and 3,000 Guernsey.

Semen imports during 1977 were lower than in previous years, a trend that is expected to continue because of high prices for imported semen, the growing artificial insemination industry in Brazil, and Brazilian regulations limiting imports to semen from high-performance bulls.

Brazil does not publish data on the value of frozen bovine semen imports, but U.S. exports of all types of bull semen to Brazil in fiscal 1977 were valued at $804,000.

Both breeding cattle and semen enter Brazil duty-free and not subject to the 100 percent, 360-day prior deposit regulation that applies to most other imports.

This favorable treatment is granted to stimulate improvement in productivity of the country's livestock sector. Brazil's animal health requirements are stringent, but are attainable. For the text of these requirements, write the Animal and Plant Health Inspection Service, Veterinary Services (Export), U.S. Department of Agriculture, Washington, D.C. 20250.

Probably the biggest obstacle to exporting dairy breeding animals and semen to Brazil is competition. Sellers tend to be aggressive, and buyers demand attention and good followup services.

Sellers in Uruguay and Argentina have a price advantage that can be met only by offering top-quality animals. Canadian exporters are marketing Holsteins through a very active sales program and West Germany exporters are stressing the performance data on Simental cattle.

The most effective way to meet such a heavy competition is through personal contact with importers, by having trained personnel accompany all shipments of cattle, and by followups on sales already made.

Potential importers can be met at the many livestock expositions in Brazil, including the annual National Holstein Exhibit, the various state and regional dairy cattle shows, and at the annual Esteio show in Rio Grande do Sul.

State Governments are beginning to import large lots of high-quality animals for resale to individual breeders, and farm cooperatives comprise another new market.

Many cooperatives—in addition to those traditionally engaged in dairying—are interested in counseling their members to improve their dairy operations or to enter dairy farming as a way to broaden their income base. These cooperatives are now importing breeding stock for sale to their members.

Minas Gerais, which accounts for about 30 percent of the country's milk output, is Brazil's most important dairy state, and others—in order of dairy importance—are São Paulo, Rio Grande do Sul, and Goias.

São Paulo State has the most modern dairy industry and accounts for the greatest number of registered purebred dairy cattle imports. Others in order of importance as import destinations are Paraná, Minas Gerais, and Rio Grande do Sul. □

Mexico To Import More Wheat, Barley, Sorghum in 1978/79

Despite increased production of wheat and barley in 1978/79, Mexico is likely to import more of these grains from the United States. Sorghum imports also will be up, but those of corn off somewhat.

Improved ground moisture at planting time is the major factor in the projected increase of wheat, corn, and sorghum production over 1977/78 levels.

However, a water shortage in the main rice producing region is likely to cause a smaller total outturn.

The 1978/79 (July-June) wheat crop is forecast at 2.7 million metric tons, compared with 2.3 million tons for 1977/78. Imports—almost all from the United States—are projected at about 900,000 tons, up significantly from 1977/78's 620,000 tons.

The spring/summer 1978 corn harvest was about 8.9 million tons—equal to last year's—and the fall/winter cycle outturn should bring the total for the 1978/79 (October-September) year to 9.8 million tons.

Corn imports during 1978/79 are estimated at 1.7 million tons, only 50,000 tons below last year's record level.

Sorghum production during 1978/79 (October-September) is forecast at 3.1 million tons—a smaller outturn than projected earlier because of continued dryness and a reduction in area. Imports—over 70 percent from the United States—may reach 1 million tons, 72 percent more than in the previous year.

Rice production during 1978/79 (October-September) is projected at 250,000 tons (milled), compared with 330,000 tons in 1977/78. Exports during 1978/79 are expected to total no more than 10,000 tons, compared with 60,000 tons in 1977/78

Barley output for 1978/79 is forecast at 465,000 tons, up from 410,000 tons in 1977/78. Imports during 1978/79 are forecast at 40,000 tons, compared with only 6,000 tons a year earlier.

A shortage of railway locomotives at harvesttime delayed 1978 imports of corn, sorghum, and wheat. Priority was given for locomotives and cars to move grain from the harvest areas in the north, especially for crops in danger of rain damage.

Mexico's long-range program to increase food self-sufficiency includes increased efforts to encourage use of improved seed and fertilizer, more use of irrigation and improvement of existing irrigation systems, and expanded use of grazing land for crop production.

Even if only some of these efforts are successful, grain production is expected to increase because of expanded area and higher yields.

The higher production probably will be in rice and coarse grains. Wheat production is not expected to rise much beyond the 3.5-million-ton level. Mexico's wheat is produced under irrigation, and meets competition for water from other crops.—*Based on dispatches from Donald M. Nelson, U.S. Agricultural Attaché, Mexico City.* □

'Confidence' Marks Outlook for Foodgrains

Despite an increase in world foodgrain production and a further buildup in stocks in 1978/79, the outlook may be characterized as one of "confidence" that a closer supply/demand balance will emerge downstream, according to Donald J. Novotny, Acting Director of Grain and Feed Division, FAS Commodity Programs, in a speech at USDA's Food and Agricultural Outlook Conference in mid-November.

In evaluating the outlook, more emphasis should be placed upon long-term trends in yields, usage, supply, and planted area at the global level rather than concentrating on the results of just one season, Novotny said. Excerpts of his speech follow.

Not all the figures are in yet, but at last count it appears that world wheat and rice crops for 1978 will be more than 50 million metric tons above those of a year earlier. Wheat alone is up more than 40 million tons to an estimated 422 million and rice is up more than 10 million tons to an estimated 376 million.

Despite the U.S. set-aside for the 1978 crop—the first set-aside in many years, it now appears that the global stocks buildup for wheat will be on the order of 15 million tons, pushing total stocks to about 96 million tons. Without the U.S. wheat set-aside, the buildup would merely have been another 5 or 6 million tons larger. For rice, too, a stocks buildup is in the making—not only in the United States, but overseas as well.

Events of recent years, however, have shown that it is a mistake to allow any long-term assessment to be influenced too much by the situation that evolves in one particular season.

The key word in this year's world outlook for foodgrains is "confidence," which has been developing over recent months. This confidence:

- Is exhibited in the continued growth of the needs of importing countries;
- Is increasing in the new farmer reserve program in the United States; and
- Has been persistent among U.S. farmers that they can hold their supplies, and that other exporting countries will not simply take away the foreign markets for U.S. grains.

Aspects of 'Confidence'

Another aspect of this confidence relates to our knowledge of the market—how to tell short-term occurrences from more basic ones and understanding how production and usage react to different developments. In still another way, there is confidence in the ability of the United States to work along commodity lines with other countries, to at least understand them better and possibly even to do things more in harmony. FAS market development programs also play a very important part in this area of knowledge, understanding, and working together with foreign countries.

Fundamentally, in all of these forms of confidence, we are dealing with the global, longer term balance between supplies and requirements. The tools available for adjustments and the market systems within which the world wheat economy operates are a long way from being perfect.

Nonetheless, the world does have a certain ability to seek a reasonable balance between supplies and requirements of food-grains—a kind of balance that provides returns growers must have while providing a dependable, ongoing supply to meet the needs of consumers around the world. This ability has improved considerably in recent years, and has not been significantly altered by the circumstances of the current season.

Turning to the specifics of world foodgrains, the 1978 world wheat crop has benefited from extraordinarily good weather, with very few countries experiencing poor wheat-growing weather.

If global wheat yields during 1978 had been in line with the trend of recent years, world outturn would have been smaller by approximately 5 percent, or 22 million tons. Conceivably, it could be argued that higher world prices or new technological changes should have led to the expectation of a yield higher than the trend figure. On this basis, it might be argued that the extra 22 million tons is not entirely due to unusual weather. But this is doubtful.

If there were a basis for some new burst of technology at the global level or if there were some response to increased levels of world prices, it would not have waited until 1978 to emerge. Instead, it already would have come forward in earlier years, such as 1973, 1974, or later. If anything, there already may have been such an extra increase in yields during those years that is already influencing the trend calculation unduly for purposes of extrapolation. Shifts toward higher yielding varieties continue to occur in some countries, but, at the global level, the jump in wheat yields in 1978/79 is still largely because of favorable weather.

As indicated, roughly 15 million tons are expected to be added to the world's carryover stocks by the end of the current marketing season. Several points should be mentioned about the prospective global carryout level. First, as a percent of utilization, the carryout remains far below the levels experienced prior to 1972. Secondly, a large part of that stock increase is likely to center in the Soviet Union where wheat stocks are believed to have been quite low until this year.

Factor of Yields

Thirdly, and perhaps most importantly, it should be remembered that if yields during 1978 had been merely at the trend level, there would have been a decrease in stocks in the current marketing year. And, if yields had been below trend by 22 million tons—instead of above by that amount, the global carryout figure certainly would have fallen to something below 70 million tons. At that level, when related to the increased level of world consumption, stocks would have been as low as at any time in the 1972-75 period.

The point now could be made that, after all, yields in 1979 again might be above trend. In that case, another 15 million tons would be added to stocks.

But here is where "confidence" becomes even more important. First of all, there is a strong probability that the world's performance in 1978 will not be repeated in 1979. And secondly, there is an equal probability that even if it does happen, there will be another combination of years to follow when yields will fall short of the trend by just as much. Suppose, for instance, that the next 2 years were to experience sharply below-trend yields at the global level. Certainly, in that event carryover stocks would be as low or lower—in relation to utilization—than the 61.5 million tons recorded in 1975/76.

Planted area is another consideration. World wheat area is hardly increasing at all, which tends to verify giving primary attention to yields.

The next point concerns wheat utilization. Although at present there are only tentative projections for the 1978/79 season, a look at historical data shows this element to be quite predictable. Feed utilization fluctuates somewhat, and a relatively low level is seen for 1978/79. So, the projected increment in total utilization is already somewhat smaller than could be expected from the normal increase in wheat used for purposes other than animal feeding. Another element in the yearly fluctuation relates to the Soviet waste loss adjustment, which is relatively low for 1978/79.

In general, an annual wheat utilization increment of roughly 10 million tons is expected at the global level. Meanwhile, trend figures for world wheat yields indicate an annual increase of about 2 percent, which represents a yearly production increase of only about 8 million tons, unless there is an increase in plantings.

Thus, there is a fairly close balance between the growth in usage and the growth in supply when the effect of fluctuating weather conditions is removed. In fact, the difference between 10 million tons in increased wheat usage and 8 million tons in increased wheat production suggests that unless there is a slowdown in foreign usage or a pickup in foreign area and/or yields—none of which seems likely, then it ought to be possible within a relatively few years to stop worrying about production restraints.

Again, this would seem to support the view that "confidence" is a reasonable way to characterize the world wheat outlook.

Special Features

There are some important special features of the world wheat situation. If a new international wheat agreement emerges, and becomes effective next summer, it could have a bearing on the short-term outlook. If the agreement commits all countries to put aside certain reserves, it could well be that some countries would not have those reserves in hand at the time the put-aside is to take place. To that extent, there would be some additional world demand for stock-building purposes during 1979/80.

Another aspect of the agreement is the joint program of supplementary adjustments that member countries might undertake as a backup in the event that triggering of the joint reserves acquisition program does not, by itself, arrest a downward movement of prices. For example, it could be that in such a situation, there would be plans for member countries to jointly undertake a certain degree of production restraint. This also would represent an addition to the world's ability to try to maintain a reasonable ongoing balance between world supplies and requirements.

The question of burden sharing by other countries, whether or not dealt with in a new wheat agreement, will probably draw increased attention in light of the additional accumulation of world stocks taking place in 1978/79. It seems that a strong case exists for other countries, particularly the exporters of wheat, to undertake a share of the task of helping to avoid an excessive short-term accumulation of global stocks. It is in their interest and they have taken this kind of step in the past.

Another somewhat related factor in the world outlook—and which is a particularly difficult problem at this time—is the practice of subsidized wheat exports by some countries. The European Community (EC) currently has a standing export subsidy of over $100 per ton for its surplus soft wheat, and there are reports that in certain instances subsidies as large as $125 per ton have been granted.

The case with the EC is especially complicated because its subsidies on wheat—which may well cost the Community close to a billion dollars this year—are financed in part by its import levels on U.S. shipments of Durum and hard wheats, which hold down usage of those wheats in Community countries. □

Danes Buy First Shipment Of U.S. Breeding Swine

In an effort to diversify its pork product for export through expansion of its breed base Denmark recently imported high-quality U.S. breeding swine—the first such imports on record.

On October 5, some 93 head of U.S. breeding swine—Hampshire, Duroc, and Yorkshire—were airshipped from Chicago to Denmark, the world's leading exporter of pork products.

Danish interest in U.S. breeding swine followed the exhibition of U.S. swine at the FAS-sponsored U.S. exhibit at the annual International Swine Show in Reggio Emilia in northern Italy. FAS has participated in the show for the past 3 years and plans to take part again in the 1979 show scheduled for April 28-May 1.

Exports of U.S. breeding swine during 1978 were expected to about equal the 12,103 head shipped in calendar 1977.

Although Denmark ranked as the 12 largest pork producer in 1977, the Danes account for about one-third of the world's exports. Domestic production continues to be based on the Danish Landrace, a long, slim hog with an extra rib. This hog was developed especially for the U.K. bacon market. Danish bacon exports totaled 215,000 metric tons in 1977 with about 210,000 tons going to the United Kingdom, the

world's biggest importer of pork products.

However, because of an increasing need for the Danes to diversify their pork exports from the United Kingdom to other European Community (EC) members, efforts are underway to develop a heavier and "hammier" hog through crossbreeding programs carried out with Yorkshire, Duroc, and Hampshire breeds. The first-ever purchase of U.S. breeding swine is part of this ongoing program.

The importance of the pork industry to Denmark's economy is underlined by the fact that pork products account for more than 40 percent of the country's farm exports and about 10 percent of total exports. Agricultural exports rang up a surplus of $1.9 billion in 1977 while Denmark's overall trade stood in a deficit of $3.3 billion.

Hogs outnumber people in Denmark, with hog numbers at any one time running between 8 and 9 million head in this country of just over 5 million people. Commercial hog slaughter in 1977 amounted to 10.8 million head and was expected to rise to about 11.6 million in 1978 and even further in 1979.

Denmark's pork production on a carcass weight basis was estimated at 760,000 tons in 1978, compared with 744,000 in 1977 and 716,000 in 1976. Pork production is expected to expand about 8 percent in 1979. Of 1977's output, 525,000 tons were exported, with about 70 percent going to the United Kingdom—illustrating the Danish hog industry's dependence on that market.

The U.S. market, accounting for only about 8 percent of Denmark's pork exports in 1977, took 40,000 tons of Danish canned hams and shoulders—or 80 percent of Denmark's total shipments of 50,000 tons.

In recent years, however, Danish pork exports to the United States have been hampered by the decline of the dollar, higher prices for feedstuffs, and increasing competition from East European countries. In addition, the 1975 U.S. countervailing duty waiver has limited EC export subsidies to about 8 percent of the export value. Denmark's effort to develop alternatives to the important U.S. canned ham market has not been very successful thus far.

Since Denmark joined the EC in 1973, consolidation of the country's hog slaughterhouses has accelerated to a point where production is concentrated into a few large units. About 80 percent of all Danish meat canning takes place in slaughterhouses controlled by just four cooperatives.—*Based on a report from the Office of U.S. Agricultural Attaché, Copenhagen.* □

International Meetings—January

Date	*Organization and location*
22-26	**FAO Commission on Fertilizers, Rome.**
29-Feb. 23	**UNCTAD Negotiating Conference on Cocoa, Geneva.**
29-31	**OECD Conference for Agriculture, Paris.**

$279.5 Million in Credits Set Under Export Program

Export credits valued at a total $279,500,000 were approved during October 13-November 17 under USDA's CCC Export Credit Sales Program.

A $75-million credit for Portugal is to finance sales of $22 million worth of U.S. soybean meal (approximately 97,353 metric tons), $5 million worth of rice (15,000 tons), $1 million of tallow (1,680 tons), $10 million of wheat (71,000 tons), and $37 million of feedgrains (372,000 tons).

A $50-million credit for the Philippines covers sale of $24 million worth of U.S. wheat (approximately 171,000 tons), $4 million of feedgrains (40,000 tons), $10 million of soybean meal (44,252 tons), and $12 million of tobacco (2,722 tons).

Pakistan also received a $50 million credit. It applies to export sales of $45 million worth of vegetable oils (approximately 69,200 tons) and $5 million worth of wheat (35,335 tons).

A $35-million credit for Egypt covers export of approximately 100,000 bales of U.S. cotton.

Pakistan received a $28,-million credit to finance export sales of about 196,422 tons of U.S. wheat.

An $18.5-million credit for Hungary was established to finance sales of about 85,195 tons of protein meals—cottonseed, linseed, soybean, and/or sunflowerseed.

Thailand received a $13-million credit to finance export sales of about 38,000 bales of U.S. cotton.

A $10-million credit for Yugoslavia is to finance export sale of about 36,364 tons of U.S. soybeans.

A total of $4.8 million in credits previously allocated to finance sales of U.S. protein meals to Poland has been switched to feedgrains, bringing total feedgrain credits for Poland during fiscal 1979 to $82.8 million and reducing the total for protein meal from $60 million to $55.2 million.

Potatoes (including seed potatoes and dehydrated potatoes) have been added to the list of eligible commodities for CCC export financing. The complete list of eligible commodities follows: Barley, breeding cattle and swine, yellow corn, cotton, cottonseed meal and oil, linseed oil and meal, complete mixed feeds containing at least 85 percent eligible commodities, oats, peanut oil, potatoes, protein concentrates containing at least 75 percent eligible commodities, rice, sorghum, soybeans, soybean meal and oil, edible soy protein, sunflowerseed oil, tallow, tobacco, wheat, and wheat flour.

Interest rates for financing sales of U.S. agricultural commodities under CCC Export Credit Sales Program on November 17 were increased by 1 percentage point.

The new rates for 6- to 36-month credit terms are 10.5 percent with a U.S. bank guarantee and 11.5 percent with a foreign bank repayment guarantee. □

Index to Foreign Agriculture, 1978

F

Month/Day

G

H

I

Mc

M

N

Q-R

Month/Day

S

Foreign Agriculture

Vol. XVI No. 52
December 25, 1978

Bob Bergland, Secretary of Agriculture.

Dale E. Hathaway, Assistant Secretary for International Affairs and Commodity Programs.

Thomas R. Hughes, Administrator, Foreign Agricultural Service.

Editorial Staff:
Kay Owsley Patterson, Editor
Beverly J. Horsley, Assoc. Editor; G. H. Baker; Marcellus P. Murphy; Aubrey C. Robinson; Lynn A. Krawczyk; Isabel A. Smith.

The Secretary of Agriculture has determined that publication of this periodical is necessary in the transaction of public business required by law of this Department. Use of funds for printing *Foreign Agriculture* has been approved by the Director, Office of Management and Budget, through June 30, 1979. Yearly subscription rate: $38.00 domestic, $48.00 foreign; single copies 80 cents. Order from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Contents of this magazine may be reprinted freely. Use of commercial and trade names does not imply approval or constitute endorsement by USDA or Foreign Agricultural Service.

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